Figure 1:

Amino acid sequences of Cpn60 and Cpn10:

SEQ ID No 1: Cpn10 (encoded by nucleotides pos. 458-751 of Figure 2):

MKIRPLHDRIVVRRKEEETATAGGIILPGAAAEKPNQGVVISVGTGRILDNGSVQALA
VNEGDVVVFGKYSGQNTIDIDGEELLILNESDIYGVLEA

SEQ ID No 2: Cpn60 (encoded by nucleotides pos. 800-2446 of Figure 2):

MAAKDVLFGDSARAKMLVGVNILADAVRVTLGPKGRNVVIEKSFGAPIITKDGVSV
AREIELKDKFENMGAQMVKEVASQANDQAGDGTTTATVLAQAIISEGLKSVAAGMN
PMDLKRGIDKATAAVVAAIKEQAQPCLDTKAIAQVGTISANADETVGRLIAEAMEKV
GKEGVITVEEGKGLEDELDVVEGMQFDRGYLSPYFINNQEKMTVEMENPLILLVDKK
IDNLQELLPILENVAKSGRPLLIVAEDVEGQALATLVVNNLRGTFKVAAVKAPGFGD
RRKAMLQDLAILTGGQVISEELGMSLETADPSSLGTASKVVIDKENTVIVDGAGTEAS
VNTRVDQIRAEIESSTSDYDIEKLQERVAKLAGGVAVIKVGAGSEMEMKEKKDRVD
DALHATRAAVEEGVVAGGGVALIRALSSVTVVGDNEDQNVGIALALRAMEAPIRQI
AGNAGAEGSVVVDKVKSGTGSFGFNASTGEYGDMIAMGILDPAKVTRSSLQAAASI
AGLMITTEAMVADAPVEEGAGGMPDMGGMGGMGGMPGMM

Figure 2:

SEQ ID No 3: DNA coding for Cpn60 and Cpn10:

Cpn10, pos. 458-751

Cpn60, pos. 800-2446

atcaaaaaatgcagcaaggacagattcctgcccaagaattagcagaaggtttcttgttagcactggccggcgctttattattaacgccgg
gttttgtcactgatgcgctgggttttacattactcgtccccgcgacgcgtaaagcgttggtccataaggtgattgcatttattacccctc
gcatgatgactgcaagcagctttcaagcgacgggtagttttcaggaaggctcgtttaaagatgtacattcgcacactgactcgcaaagca
gtcatgaaaaaatcacaattgaaggcgaatataccaaagacgataagtaggtatttttttcggctagccgttgaaatcctagtaaaagccc

cgataaattaaccatctatttttcacagaggcaatttagcctttgtttaccttattgatcctaatacttgggatccaacagttggagagtctagc
aaatgaaaatccgtccattacatgatcgtattgttgttcgccgtaaagaagaagagaccgcaactgcgggtggtattattttacc
gggcgctgcggcagaaaaaccaaatcaaggtgttgttatctctgtgggtactggccgtattcttgataatggttcagtgcaagcgctggc
ggttaacgaaggcgatgttgtcgttttggtaaatactcaggtcaaaatactatcgatatcgatggtgaagaattattgattttgaatga
aagtgatatctacggcgttttagaagcttaattattacactcacttttttatttaacctacaaaatttaaggaaagatcatggctgctaaagacg
tattatttggtgatagcgcacgcgcaaaaatgttggtaggtgtaaacattttagccgacgcagtaagagttaccttaggacctaa
aggtcgtaacgttgttatagaaaaatcatttggtgcaccgatcatcaccaaagatggtgtttctgttgcgcgtgaaatcgaattgaaagaca
aattcgaaaacatgggcgcacagatggttaaggaagttgcttctcaagccaacgaccaagccggtgacggcacaacgacagcgact
gtactagcacaggcgattatcagcgaaggcttgaaatctgttgcggctggcatgaatccaatggatcttaaacgtggtattgataaagcta
cggctgctgttgttgccgccattaaagaacaagctcagccttgcttggatacaaaagcaatcgctcaggtagggacaatctctgccaatg
ccgatgaaacggttggtcgtttaattgctgaagcgatggaaaaagtcggtaaagaaggtgtgattaccgttgaagaaggcaaaggcctt
gaagacgagcttgatgttgtagaaggcatgcagttcgatcgcggttacttgtctccgtacttcatcaacaaccaagaaaaaatgaccgta
gaaatggaaaatccattaattctattggttgataagaaaattgataaccttcaagagctgttgccaattcttgaaaacgtcgctaaatcaggt
cgtccattattgatcgttgctgaagatgttgaaggccaagcactagcaacattggtagtaaacaacttgcgcggcacattcaaggttgc
agcggttaaagcccctggttttggcgatcgtcgtaaagcgatgttgcaagatcttgccatcttgacgggtggtcaggttatttctgaagag
ctagggatgtctttagaaactgcggatccttcttctttgggtacggcaagcaaggttgttatcgataaagaaaacaccgtgattgttga
tggcgcaggtactgaagcaagcgttaatactcgtgttgaccagatccgtgctgaaatcgaaagctcgacttctgattacgacatcgaaaa
gttacaagaacgcgttgctaagcttgcgggcggcgttgccgtgattaaggttggtgcgggttctgaaatggaaatgaaagagaagaaa
gaccgtgttgacgatgcacttcatgcaactcgcgcagcggttgaagaaggtgttgttgcgggtggtggtgttgctttgattcgcgcactct
cttcagtaaccgttgttggtgataacgaagatcaaaacgtcggtattgcattggcacttcgtgcgatggaagctcctatccgtcaaatcgc
gggtaacgcaggtgctgaagggtcagtggttgttgataaagtgaaatctggcacaggtagctttggttttaacgccagcacaggtgagt
atggcgatatgattgcgatgggtattttagaccctgcaaaagtcacgcgttcatctctacaagccgcggcgtctatcgcaggtttgatgat
cacaaccgaagccatggttgcggatgcgcctgttgaagaaggcgctggtggtatgcctgatatgggcggcatgggtggaatgggcg
gtatgcctggcatgatgtaatcactttgtgattcattgtcctgatctgcttaccgtgtaaaaagatcaggctcaaggctgtctctataaaaag
ccgtatctttgatgagtgttgtctttctgctgaaaacgacattcttggagtgcggctttttttgattttggtcataaaattcagaatattgtgtaatt
ttatgtaactagctggcctataatgttgagttcctctgggtggcatgatctcatggtacttcacttaagcctgattcactgcg
gctttaacagtaaaataataacgcaacgtagaaacataataagcgtatggcattaatgaagacggctgcatttaattcagatc

Figure 3:

SEQ ID No 4: Amino acid sequence of esterase cloned from *Oleispira antarctica* (EstRB8):

EstRB8 (encoded by nucleotides 1145 to 2143 Frame 2 of Figur 4) 333 aa

MKNTLKSSSRFSLKQLGTGALIISSLFFGGCTTTQQDNLYTGVMSLARDSAGLEVKTA
SAGDVNLTYMERQGSDKDNAESVILLHGFSADKDNWILFTKEFDEKYHVIAVDLAG
HGDSEQLLTTDYGLIKQAERLDIFLSGLGVNSFHIAGNSMGGAISAIYSLSHPEKVKSL
TLIDAAGVDGDTESEYYKVLAEGKNPLIATDEASFEYRMGFTMTQPPFLPWPLRPSLL
RKTLARAEINNKIFSDMLKTKERLGMTNFQQKIEVKMAQHPLPTLIMWGKEDRVLD
VSAAAAFKKIIPQATVHIFPEVGHLPMVEIPSESAKVYEEFLSSIK

Figure 4:

SEQ ID No 5: DNA fragment from plasmid pBK1Est coding for esterase of *Oleispira antarctica* (EstRB8):

Nucleotide positions 1-100 correspond to reverse complement of positions 1196-1121 and 3799-3939 correspond to reverse complement of 1043-952 of pBK-CMV vector (Stratagene).

Positions 101-105 are *BamH*I – *Sau*3A1 fusion and positions 3795-3798 are *Sau*3A1-*Bam*HI-fusion.

acaggaaacagctatgaccttgattacgccaagctcgaaattaaccctcactaaagggaacaaaagctggagctcgcgcgcctgcag
gtcgacactagtggatcaacggcgttcatggtactggctgagttcagcgtcataatgccgatgcgatactggccgtcatgactgagtact
tcttctgctagcaccgatttttctaatagcgcagcttcttttatttctgaacgggcaactgatgtagtttttttactaaccggcttttaggcatgg
taaactcttcgatattcaaaattattactgttcatattacaatcatagtacaggctagaggcccaaaattgcagctgatattcacctttattattc
taagcattattacactcatcgcggtgttattaattgtgctaaataaaaatacccgtagcggaaaaattcagcaaatagccaaagaaaacga
ttggcaataccaagaattcatcgattttgatgatgacattaagcaggcaaactttggcctattaaactacagtcaaaatgcaatttttagacat
ctcattcaagcaactgacgaacactatggcttagcgtttaagacctttgactgtcgagcgttagaaccttcaggtattcacaatagcagtct
tattttatttaccctcgcactaaagactgaattcaataacctacacatttgcttaagtcgacatattcaagataaagatgccttcactgacatca
gtcaccaacaatcaatcaaacaccaataccaatcgcaaaaactcataaaactagccgatcaccaaatcccaaaagcgttcaaaaatgaa
acgagcacgtcacacaaaatcaatttatacgctaacgaaccaggtcaaacttatcgtttttttgagcacgtttgttccactaatgaaagaga
aaagtcgttaattcactggcttttggcgtatccgcaccttcacatagaaattagtaatggcatgctactggcctttaaaaagaatcagttaatt
gaagaaacctcgcttatctcagccattaccgctgtagccgaatttgcgcttatcctcagccatgattaaactgacgccaattaatataagac
atactaattaataactcccttaattgagaagaataatgaaaaacacactcaaatcctcatcacgttttagtctgaaacaactcggcaccggc
gctctgattatctccagtttgttcttcggtggttgcaccacaacacaacaagataatttatacacaggggttatgtctcttgcgagagacagc
gctggcctagaagttaaaacagcctctgccggtgacgtcaatcttacttatatggaacgccaaggcagtgacaaagataatgccgaaag

cgttattttattacacggtttctctgctgataaagataactggattctttttaccaaagaattcgatgaaaaatatcatgttatcgctgtcgattta
gcgggacatggcgattcagaacaattattaacgactgattacggtctcataaaacaagccgagcgtttagatatcttcttatctggcttagg
ggttaactcatttcacatcgccggtaattcaatgggggggctatcagcgcaatctacagtttgagtcacccagagaaagttaaaagtctt
acattgatcgatgcagcaggtgtcgatggcgatactgaaagcgaatactacaaagttttggcagaaggtaagaatcctttaattgcaact
gatgaagcaagttttgaataccgcatgggtttcaccatgactcagcctcctttcctaccttggccactaagaccttctttattacgtaaaacg
ctagcccgtgccgagatcaataacaaaatttttttccgatatgctgaaaaccaaagaacgtttaggaatgactaactttcaacagaaaattg
aagtgaaaatggctcaacatccattgccaacactgattatgtggggcaaagaagatcgcgttcttgacgtatccgcagcagcggccttc
aaaaaaataattccacaagcaactgttcatattttcctgaagtaggccacctacctatggtagaaattcctagtgaaagcgctaaagtttat
gaagagtttttgtcctctattaaataagagcacataatcatgactgacttataaacagccaagcatttaaaatgcttggctgtttatttaatgg
ccaaattattcaacgaccaagctctgcggtaaaatcgcagtgggtttcttgttttcatcaacagcaacaaacgtgaaatacccgtaatcg
cattttctgattatcaaaatacatactttccaccagcatattaacttcaacttttaaactcgtccgccctacctctataacactggcagtcaatt
cgacaatggtacctgcgggaacaggatgcttaaaatcgattcgatcactgctgacggttacgatgctttgtcgagaaaaacgagtcgct
gcaataaaagaaacctcatccatccactgcattgcagtgccaccgaataacgtatcatgatgatttgttgtctctggaaataccgctttaga
aatagtggtttttgatacgcgctttcgctgcgcaataatatcttctctgctaagagttgcggatggcatacataaactcgcttgattaagatta
ataataaatagttaacagtatattgaactgagggtctgaagaactctaatacctctgaagaactttgaggccgctagagagaaaagacca
gtgataatatttcatcttgccatgagagcttatcatgaaagcctgtgcttaaaatcaatcattatatttattcatctttaattgaaataataccaat
atatttcatatataatttcacactacccttatctcactagacttcccgcgcataggcgcaaacaatcaacgcaagttcacaataaagcggttc
gctgcaacacatgccctagcgtctaaagtagcacgcacaacactggccagtcgtactagccccttgcgattcgtgcagacgagcaac
aagcgctattaaacttacctaaatttctaaccaccaccattggttcttttccacaaactcaaaaaactcgtcaaatccgcttgcaatttaaacg
cgatgacatagatctaatcgattatcaaacccgcattcaagcgctcattaaaaacgcaccactggcaagaagttctacctgcactgacca
atatgcaagcggcggcggaagagctgcctttgatcgatcaagaagaagggagcagcaaagaggaaaacaatcaaaaagaggaga
gcaatcaaataaaaacgagttattgaggattttaattttaaaacaggtatattaataccctctctcgtagtaaacaatgactgtatttacacaa
aaataaatagaggtataccatgtcaaacatctggtttgaagtaccaaagattgaagtattaaaccgtcaaatggaaaatactgcctgcagc
aacttaggcattcaaattacagaaattggcgatgattatatcactggcacaatgccagcagatgcacgtaccttccagccaatgggactg
attcatggcggctcaaatgtattgctggcagaaacactgggcagcatggcagctaactgctgtattaatttgtctcaagaatattgtgttgg
ccaagaaattaacgccaaccacatacgcggtgttcgttccggcatagtgactggcacagcaacgctagtacacaaaggaagaacctc
ccagatttgggaaattcgcatcgttaacgatccaaagaattcaaaaagcttctcgagagtacttctagagcggccgcgggcccatcgatt
ttccacccgggtggggtaccaggtaagtgtacccaattcgccctatagtgagtcgtattacaattcactggccgtcgttttac

Figure 5:

Amino acid sequences expressed from vector pBK1CpnEst: - the co-expression of fragments encoding native chaperonines with the esterase gene (EstRB8), all from *Oleispira antarctica*

SEQ ID No 6: cpn10 (nucleotides 113 to 403: Frame 2 of Figure 6) 97 aa:

MKIRPLHDRIVVRRKEEETATAGGIILPGAAAEKPNQGVVISVGTGRILDNGSVQALA
VNEGDVVVFGKYSGQNTIDIDGEELLILNESDIYGVLEA

SEQ ID No 7: cpn60 (nucleotides 455 to 2098: Frame 2 of Figure 6) 548 aa:

MAAKDVLFGDSARAKMLVGVNILADAVRVTLGPKGRNVVIEKSFGAPIITKDGVSV
AREIELKDKFENMGAQMVKEVASQANDQAGDGTTTATVLAQAIISEGLKSVAAGMN
PMDLKRGIDKATAAVVAAIKEQAQPCLDTKAIAQVGTISANADETVGRLIAEAMEKV
GKEGVITVEEGKGLEDELDVVEGMQFDRGYLSPYFINNQEKMTVEMENPLILLVDKK
IDNLQELLPILENVAKSGRPLLIVAEDVEGQALATLVVNNLRGTFKVAAVKAPGFGD
RRKAMLQDLAILTGGQVISEELGMSLETADPSSLGTASKVVIDKENTVIVDGAGTEAS
VNTRVDQIRAEIESSTSDYDIEKLQERVAKLAGGVAVIKVGAGSEMEMKEKKDRVD
DALHATRAAVEEGVVAGGGVALIRALSSVTVVGDNEDQNVGIALALRAMEAPIRQI
AGNAGAEGSVVVDKVKSGTGSFGFNASTGEYGDMIAMGILDPAKVTRSSLQAAASI
AGLMITTEAMVADAPVEEGAGGMPDMGGMGGMGGMPGMM

SEQ ID No 8: estRB8 (nucleotides 2579 to 3577: Frame 2 of Figure 6) 333 aa:

MKNTLKSSSRFSLKQLGTGALIISSLFFGGCTTTQQDNLYTGVMSLARDSAGLEVKTA
SAGDVNLTYMERQGSDKDNAESVILLHGFSADKDNWILFTKEFDEKYHVIAVDLAG
HGDSEQLLTTDYGLIKQAERLDIFLSGLGVNSFHIAGNSMGGAISAIYSLSHPEKVKSL
TLIDAAGVDGDTESEYYKVLAEGKNPLIATDEASFEYRMGFTMTQPPFLPWPLRPSLL
RKTLARAEINNKIFSDMLKTKERLGMTNFQQKIEVKMAQHPLPTLIMWGKEDRVLD
VSAAAAFKKIIPQATVHIFPEVGHLPMVEIPSESAKVYEEFLSSIK

Figure 6:

SEQ ID No 9: pBK1CpnEst: - the fusion of native chaperonine-coding fragments with esterase of *Oleispira antarctica* (EstRB8)

The DNA fragment coding for Cpn10 and Cpn60 is flanked by *Sac*I site (pos. 69-75) and *Sal*I site (encoded by pos. 2138-2143 of Figure 7):

Nucleotide positions 1-75 correspond to reverse complement of positions 1196-1121 and positions 5233-5273 correspond to reverse complement of 1043-952 of pBK-CMV vector (Stratagene)

Small letters – the Cpn10-Cpn60 encoding fragment,
Capital italics – fragments of vector pBK-CMV
Capital letters – fragment coding for EstRB8 from plasmid pBK1Est

ACAGGAAACAGCTATGACCTTGATTACGCCAAGCTCGAAATTAACCCTCACTAAAGGGA
*ACAAAAGCTGGAGCTC*ctaatacttgggatccaacagttggagagtctagcaaatgaaaatccgtccattacatgatcgtatt
gttgttcgccgtaaagaagaagagaccgcaactgcgggtggtattattttaccgggcgctgcggcagaaaaaccaaatcaaggtgttgt
tatctctgtgggtactggccgtattcttgataatggttcagtgcaagcgctggcggttaacgaaggcgatgttgtcgtttttggtaaatactc
aggtcaaaatactatcgatatcgatggtgaagaattattgattttgaatgaaagtgatatctacggcgttttagaagcttaattattacactca
ctttttttatttaacctacaaaatttaaggaaagatcatggctgctaaagacgtattatttggtgatagcgcacgcgcaaaaatgttggtaggt
gtaaacattttagccgacgcagtaagagttaccttaggacctaaaggtcgtaacgttgttatagaaaaatcatttggtgcaccgatcatcac
caaagatggtgtttctgttgcgcgtgaaatcgaattgaaagacaaattcgaaaacatgggcgcacagatggttaaggaagttgcttctca
agccaacgaccaagccggtgacggcacaacgacagcgactgtactagcacaggcgattatcagcgaaggcttgaaatctgttgcgg
ctggcatgaatccaatggatcttaaacgtggtattgataaagctacggctgctgttgttgccgccattaaagaacaagctcagccttgcttg
gatacaaaagcaatcgctcaggtagggacaatctctgccaatgccgatgaaacggttggtcgtttaattgctgaagcgatggaaaaagt
cggtaaagaaggtgtgattaccgttgaagaaggcaaaggccttgaagacgagcttgatgttgtagaaggcatgcagttcgatcgcggtt
acttgtctccgtacttcatcaacaaccaagaaaaaatgaccgtagaaatggaaaatccattaattctattggttgataagaaaattgataac
cttcaagagctgttgccaattcttgaaaacgtcgctaaatcaggtcgtccattattgatcgttgctgaagatgttgaaggccaagcactagc
aacattggtagtaaacaacttgcgcggcacattcaaggttgcagcggttaaagcccctggttttggcgatcgtcgtaaagcgatgttgca
agatcttgccatcttgacgggtggtcaggttatttctgaagagctagggatgtctttagaaactgcggatccttcttctttgggtacggcaa
gcaaggttgttatcgataaagaaaacaccgtgattgttgatggcgcaggtactgaagcaagcgttaatactcgtgttgaccagatccgtg
ctgaaatcgaaagctcgacttctgattacgacatcgaaaagttacaagaacgcgttgctaagcttgcgggcggcgttgccgtgattaag

gttggtgcgggttctgaaatggaaatgaaagagaagaaagaccgtgttgacgatgcacttcatgcaactcgcgcagcggttgaagaag
gtgttgttgcgggtggtggtgttgctttgattcgcgcactctcttcagtaaccgttgttggtgataacgaagatcaaaacgtcggtattgcat
tggcacttcgtgcgatggaagctcctatccgtcaaatcgcgggtaacgcaggtgctgaagggtcagtggttgttgataaagtgaaatctg
gcacaggtagctttggttttaacgccagcacaggtgagtatggcgatatgattgcgatgggtattttagaccctgcaaaagtcacgcgttc
atctctacaagccgcggcgtctatcgcaggtttgatgatcacaaccgaagccatggttgcggatgcgcctgttgaagaaggcgctggtg
gtatgcctgatatgggcggcatgggtggaatgggcggtatgcctggcatgatgtaatcactttgtgattcattgtcctgatctgcttaccgt
GTCGACATATTCAAGATAAAGATGCCTTCACTGACATCAGTCACCAACAATCAAT
CAAACACCAATACCAATCGCAAAAACTCATAAAACTAGCCGATCACCAAATCCC
AAAAGCGTTCAAAAATGAAACGAGCACGTCACACAAAATCAATTTATACGCTAA
CGAACCAGGTCAAACTTATCGTTTTTTTGAGCACGTTTGTTCCACTAATGAAAGA
GAAAAGTCGTTAATTCACTGGCTTTTGGCGTATCCGCACCTTCACATAGAAATTA
GTAATGGCATGCTACTGGCCTTTAAAAAGAATCAGTTAATTGAAGAAACCTCGCT
TATCTCAGCCATTACCGCTGTAGCCGAATTTGCGCTTATCCTCAGCCATGATTAAA
CTGACGCCAATTAATATAAGACATACTAATTAATAACTCCCTTAATTGAGAAGAA
TAATGAAAAACACACTCAAATCCTCATCACGTTTTAGTCTGAAACAACTCGGCAC
CGGCGCTCTGATTATCTCCAGTTTGTTCTTCGGTGGTTGCACCACAACACAACAAG
ATAATTTATACACAGGGGTTATGTCTCTTGCGAGAGACAGCGCTGGCCTAGAAGT
TAAAACAGCCTCTGCCGGTGACGTCAATCTTACTTATATGGAACGCCAAGGCAGT
GACAAAGATAATGCCGAAAGCGTTATTTTATTACACGGTTTCTCTGCTGATAAAG
ATAACTGGATTCTTTTTACCAAAGAATTCGATGAAAAATATCATGTTATCGCTGTC
GATTTAGCGGGACATGGCGATTCAGAACAATTATTAACGACTGATTACGGTCTCA
TAAAACAAGCCGAGCGTTTAGATATCTTCTTATCTGGCTTAGGGGTTAACTCATTT
CACATCGCCGGTAATTCAATGGGGGGGGCTATCAGCGCAATCTACAGTTTGAGTC
ACCCAGAGAAAGTTAAAAGTCTTACATTGATCGATGCAGCAGGTGTCGATGGCG
ATACTGAAAGCGAATACTACAAAGTTTTGGCAGAAGGTAAGAATCCTTTAATTGC
AACTGATGAAGCAAGTTTTGAATACCGCATGGGTTTCACCATGACTCAGCCTCCT
TTCCTACCTTGGCCACTAAGACCTTCTTTATTACGTAAAACGCTAGCCCGTGCCGA
GATCAATAACAAAATTTTTTCCGATATGCTGAAAACCAAAGAACGTTTAGGAATG
ACTAACTTTCAACAGAAAATTGAAGTGAAAATGGCTCAACATCCATTGCCAACAC
TGATTATGTGGGGCAAAGAAGATCGCGTTCTTGACGTATCCGCAGCAGCGGCCTT
CAAAAAAAATAATTCCACAAGCAACTGTTCATATTTTTCCTGAAGTAGGCCACCTA
CCTATGGTAGAAATTCCTAGTGAAAGCGCTAAAGTTTATGAAGAGTTTTTGTCCT
CTATTAAATAAGAGCACATAATCATGACTGACTTATAAACAGCCAAGCATTTAAA
ATGCTTGGCTGTTTATTTTAATGGCCAAATTATTCAACGACCAAGCTCTGCGGTAA

AATCGCAGTGGGTTTCTTGTTTTCATCAACAGCAACAAACGTGAAATACCCCGTA
ATCGCATTTTTCTGATTATCAAAATACATACTTTCCACCAGCATATTAACTTCAAC
TTTTAAACTCGTCCGCCCTACCTCTATAACACTGGCAGTCAATTCGACAATGGTAC
CTGCGGGAACAGGATGCTTAAAATCGATTCGATCACTGCTGACGGTTACGATGCT
TTGTCGAGAAAAACGAGTCGCTGCAATAAAAGAAACCTCATCCATCCACTGCATT
GCAGTGCCACCGAATAACGTATCATGATGATTTGTTGTCTCTGGAAATACCGCTTT
AGAAATAGTGGTTTTTGATACGCGCTTTCGCTGCGCAATAATATCTTCTCTGCTAA
GAGTTGCGGATGGCATACATAAACTCGCTTGATTAAGATTAATAATAAATAGTTA
ACAGTATATTGAACTGAGGGTCTGAAGAACTCTAATACCTCTGAAGAACTTTGAG
GCCGCTAGAGAGAAAAGACCAGTGATAATATTTCATCTTGCCATGAGAGCTTATC
ATGAAAGCCTGTGCTTAAAATCAATCATTATATTTATTCATCTTTAATTGAAATAA
TACCAATATATTTCATATATAATTTCACACTACCCTTATCTCACTAGACTTCCCGC
GCATAGGCGCAAACAATCAACGCAAGTTCACAATAAAGCGGTTCGCTGCAACAC
ATGCCCTAGCGTCTAAAGTAGCACGCACAACACTGGCCAGTCGTACTAGCCCCTT
TGCGATTCGTGCAGACGAGCAACAAGCGCTATTAAACTTACCTAAATTTCTAACC
ACCACCATTGGTTCTTTTCCACAAACTCAAAAAACTCGTCAAATCCGCTTGCAATT
TAAACGCGATGACATAGATCTAATCGATTATCAAACCCGCATTCAAGCGCTCATT
AAAAACGCACCACTGGCAAGAAGTTCTACCTGCACTGACCAATATGCAAGCGGC
GGCGGAAGAGCTGCCTTTGATCGATCAAGAAGAAGGGAGCAGCAAAGAGGAAA
ACAATCAAAAAGAGGAGAGCAATCAAATAAAAACGAGTTATTGAGGATTTTAAT
TTTAAAACAGGTATATTAATACCCTCTCTCGTAGTAAACAATGACTGTATTTACAC
AAAAATAAATAGAGGTATACCATGTCAAACATCTGGTTTGAAGTACCAAAGATTG
AAGTATTAAACCGTCAAATGGAAAATACTGCCTGCAGCAACTTAGGCATTCAAAT
TACAGAAATTGGCGATGATTATATCACTGGCACAATGCCAGCAGATGCACGTACC
TTCCAGCCAATGGGACTGATTCATGGCGGCTCAAATGTATTGCTGGCAGAAACAC
TGGGCAGCATGGCAGCTAACTGCTGTATTAATTTGTCTCAAGAATATTGTGTTGG
CCAAGAAATTAACGCCAACCACATACGCGGTGTTCGTTCCGGCATAGTGACTGGC
ACAGCAACGCTAGTACACAAAGGAAGAACCTCCCAGATTTGGGAAATTCGCATC
GTTAAC*GATCCAAAGAATTCAAAAAGCTTCTCGAGAGTACTTCTAGAGCGGCCGCGGG*
CCCATCGATTTTCCACCCGGGTGGGGTACCAGGTAAGTGTACCCAATTCGCCCTATAGT
GAGTCGTATTACAATTCACTGGCCGTCGTTTTAC

Figure 7:

Amino acid sequences expressed from vector pBK1CpnSREst: - the co-expression of the stabilized single ring mutant chaperonin with the esterase gene (EstRB8) from *Oleispira antarctica* (cpn10::stabilized single ring mutant Glu461Ala/Ser463Ala/Val464Ala::est)

SEQ ID No 10: cpn10 (nucleotides 113 to 403: Frame 2 of Figure 8) 97 aa:

MKIRPLHDRIVVRRKEEETATAGGIILPGAAAEKPNQGVVISVGTGRILDNGSVQALA
VNEGDVVVFGKYSGQNTIDIDGEELLILNESDIYGVLEA

Below – ***Capital bold letters*** are the mutations introduced

SEQ ID No 11: stabilized single ring mutant of cpn60 (nucleotides 455 to 2098: Frame 2 of Figure 8) 548 aa:

MAAKDVLFGDSARAKMLVGVNILADAVRVTLGPKGRNVVIEKSFGAPIITKDGVSV
AREIELKDKFENMGAQMVKEVASQANDQAGDGTTTATVLAQAIISEGLKSVAAGMN
PMDLKRGIDKATAAVVAAIKEQAQPCLDTKAIAQVGTISANADETVGRLIAEAMEKV
GKEGVITVEEGKGLEDELDVVEGMQFDRGYLSPYFINNQEKMTVEMENPLILLVDKK
IDNLQELLPILENVAKSGRPLLIVAEDVEGQALATLVVNNLRGTFKVAAVKAPGFGD
RRKAMLQDLAILTGGQVISEELGMSLETADPSSLGTASKVVIDKENTVIVDGAGTEAS
VNTRVDQIRAEIESSTSDYDIEKLQERVAKLAGGVAVIKVGAGSEMEMKEKKDRVD
DALHATRAAVEEGVVAGGGVALIRALSSVTVVGDNEDQNVGIALALRAMEAPIRQI
AGNAGA*AGAA*VVDKVKSGTGSFGFNASTGEYGDMIAMGILDPAKVTRSSLQAAASI
AGLMITTEAMVADAPVEEGAGGMPDMGGMGGMGGMPGMM

SEQ ID No 12: EstRB8 (nucleotides 2579 to 3577: Frame 2 of Figure 8) 333 aa:

MKNTLKSSSRFSLKQLGTGALIISSLFFGGCTTTQQDNLYTGVMSLARDSAGLEVKTA
SAGDVNLTYMERQGSDKDNAESVILLHGFSADKDNWILFTKEFDEKYHVIAVDLAG
HGDSEQLLTTDYGLIKQAERLDIFLSGLGVNSFHIAGNSMGGAISAIYSLSHPEKVKSL
TLIDAAGVDGDTESEYYKVLAEGKNPLIATDEASFEYRMGFTMTQPPFLPWPLRPSLL

RKTLARAEINNKIFSDMLKTKERLGMTNFQQKIEVKMAQHPLPTLIMWGKEDRVLD
VSAAAAFKKIIPQATVHIFPEVGHLPMVEIPSESAKVYEEFLSSIK

Figure 8:

SEQ ID No 13: DNA sequence of vector pBK1CpnSREst: the expression cassette for the co-expression of the stabilized single ring mutant chaperonin with the esterase gene (EstRB8) from *Oleispira antarctica* (cpn10::stabilized single ring mutant Glu461Ala/Ser463Ala/Val464Ala::est)

Nucleotide positions 1-75 correspond to reverse complement of positions 1196-1121 and positions 5233-5273 correspond to reverse complement of 1043-952 of pBK-CMV vector (Stratagene)

DNA fragment coding for Cpn10 and Cpn60 is flanked by *Sac*I site (pos. 69-75) and *Sal*I site (pos. 2138-2143).

In the DNA sequence:
Small letters – the Cpn10-Cpn60 coding fragment,
Capital italics – fragments of vector
Capital letters – fragment coding for EstRB8 from plasmid pBK1Est
Capital bold letters = introduced mutations

ACAGGAAACAGCTATGACCTTGATTACGCCAAGCTCGAAATTAACCCTCACTAAAGGGA
*ACAAAAGCTGGAGCTC*ctaatacttgggatccaacagttggagagtctagcaaatgaaaatccgtccattacatgatcgtatt
gttgttcgccgtaaagaagaagagaccgcaactgcgggtggtattattttaccgggcgctgcggcagaaaaaccaaatcaaggtgttgt
tatctctgtgggtactggccgtattcttgataatggttcagtgcaagcgctggcggttaacgaaggcgatgttgtcgttttttggtaaatactc
aggtcaaaatactatcgatatcgatggtgaagaattattgattttgaatgaaagtgatatctacggcgttttagaagcttaattattacactca
ctttttttatttaacctacaaaatttaaggaaagatcatggctgctaaagacgtattatttggtgatagcgcacgcgcaaaaatgttggtaggt
gtaaacattttagccgacgcagtaagagttaccttaggacctaaaggtcgtaacgttgttatagaaaaatcatttggtgcaccgatcatcac
caaagatggtgtttctgttgcgcgtgaaatcgaattgaaagacaaattcgaaaacatgggcgcacagatggttaaggaagttgcttctca
agccaacgaccaagccggtgacggcacaacgacagcgactgtactagcacaggcgattatcagcgaaggcttgaaatctgttgcgg
ctggcatgaatccaatggatcttaaacgtggtattgataaagctacggctgctgttgttgccgccattaaagaacaagctcagccttgcttg

gatacaaaagcaatcgctcaggtagggacaatctctgccaatgccgatgaaacggttggtcgtttaattgctgaagcgatggaaaaagt
cggtaaagaaggtgtgattaccgttgaagaaggcaaaggccttgaagacgagcttgatgttgtagaaggcatgcagttcgatcgcggtt
acttgtctccgtacttcatcaacaaccaagaaaaaatgaccgtagaaatggaaaatccattaattctattggttgataagaaaattgataac
cttcaagagctgttgccaattcttgaaaacgtcgctaaatcaggtcgtccattattgatcgttgctgaagatgttgaaggccaagcactagc
aacattggtagtaaacaacttgcgcggcacattcaaggttgcagcggttaaagcccctggttttggcgatcgtcgtaaagcgatgttgca
agatcttgccatcttgacgggtggtcaggttatttctgaagagctagggatgtctttagaaactgcggatccttcttctttgggtacggcaa
gcaaggttgttatcgataaagaaaacaccgtgattgttgatggcgcaggtactgaagcaagcgttaatactcgtgttgaccagatccgtg
ctgaaatcgaaagctcgacttctgattacgacatcgaaaagttacaagaacgcgttgctaagcttgcgggcggcgttgccgtgattaag
gttggtgcgggttctgaaatggaaatgaaagagaagaaagaccgtgttgacgatgcacttcatgcaactcgcgcagcggttgaagaag
gtgttgttgcgggtggtggtgttgctttgattcgcgcactctcttcagtaaccgttgttggtgataacgaagatcaaaacgtcggtattgcat
tggcacttcgtgcgatggaagctcctatccgtcaaatcgcgggtaacgcaggtgctgCagggGcagCggttgttgataaagtgaaat
ctggcacaggtagctttggttttaacgccagcacaggtgagtatggcgatatgattgcgatgggtattttagaccctgcaaaagtcacgc
gttcatctctacaagccgcggcgtctatcgcaggtttgatgatcacaaccgaagccatggttgcggatgcgcctgttgaagaaggcgct
ggtggtatgcctgatatgggcggcatgggtggaatgggcggtatgcctggcatgatgtaatcactttgtgattcattgtcctgatctgctta
ccgtGTCGACATATTCAAGATAAAGATGCCTTCACTGACATCAGTCACCAACAATC
AATCAAACACCAATACCAATCGCAAAAACTCATAAAACTAGCCGATCACCAAAT
CCCAAAAGCGTTCAAAAATGAAACGAGCACGTCACACAAAATCAATTTATACGC
TAACGAACCAGGTCAAACTTATCGTTTTTTTGAGCACGTTTGTTCCACTAATGAAA
GAGAAAAGTCGTTAATTCACTGGCTTTTGGCGTATCCGCACCTTCACATAGAAAT
TAGTAATGGCATGCTACTGGCCTTTAAAAAGAATCAGTTAATTGAAGAAACCTCG
CTTATCTCAGCCATTACCGCTGTAGCCGAATTTGCGCTTATCCTCAGCCATGATTA
AACTGACGCCAATTAATATAAGACATACTAATTAATAACTCCCTTAATTGAGAAG
AATAATGAAAAACACACTCAAATCCTCATCACGTTTTAGTCTGAAACAACTCGGC
ACCGGCGCTCTGATTATCTCCAGTTTGTTCTTCGGTGGTTGCACCACAACACAACA
AGATAATTTATACACAGGGGTTATGTCTCTTGCGAGAGACAGCGCTGGCCTAGAA
GTTAAAACAGCCTCTGCCGGTGACGTCAATCTTACTTATATGGAACGCCAAGGCA
GTGACAAAGATAATGCCGAAAGCGTTATTTTATTACACGGTTTCTCTGCTGATAA
AGATAACTGGATTCTTTTTACCAAAGAATTCGATGAAAAATATCATGTTATCGCT
GTCGATTTAGCGGGACATGGCGATTCAGAACAATTATTAACGACTGATTACGGTC
TCATAAAACAAGCCGAGCGTTTAGATATCTTCTTATCTGGCTTAGGGGTTAACTC
ATTTCACATCGCCGGTAATTCAATGGGGGGGGCTATCAGCGCAATCTACAGTTTG
AGTCACCCAGAGAAAGTTAAAAGTCTTACATTGATCGATGCAGCAGGTGTCGATG
GCGATACTGAAAGCGAATACTACAAAGTTTTGGCAGAAGGTAAGAATCCTTTAAT
TGCAACTGATGAAGCAAGTTTTGAATACCGCATGGGTTTCACCATGACTCAGCCT

CCTTTCCTACCTTGGCCACTAAGACCTTCTTTATTACGTAAAACGCTAGCCCGTGC
CGAGATCAATAACAAAATTTTTTCCGATATGCTGAAAACCAAAGAACGTTTAGGA
ATGACTAACTTTCAACAGAAAATTGAAGTGAAAATGGCTCAACATCCATTGCCAA
CACTGATTATGTGGGGCAAAGAAGATCGCGTTCTTGACGTATCCGCAGCAGCGGC
CTTCAAAAAAATAATTCCACAAGCAACTGTTCATATTTTTCCTGAAGTAGGCCAC
CTACCTATGGTAGAAATTCCTAGTGAAAGCGCTAAAGTTTATGAAGAGTTTTTGT
CCTCTATTAAATAAGAGCACATAATCATGACTGACTTATAAACAGCCAAGCATTT
AAAATGCTTGGCTGTTTATTTTAATGGCCAAATTATTCAACGACCAAGCTCTGCG
GTAAAATCGCAGTGGGTTTCTTGTTTTCATCAACAGCAACAAACGTGAAATACCC
CGTAATCGCATTTTTCTGATTATCAAAATACATACTTTCCACCAGCATATTAACTT
CAACTTTTAAACTCGTCCGCCCTACCTCTATAACACTGGCAGTCAATTCGACAATG
GTACCTGCGGGAACAGGATGCTTAAAATCGATTCGATCACTGCTGACGGTTACGA
TGCTTTGTCGAGAAAAACGAGTCGCTGCAATAAAAGAAACCTCATCCATCCACTG
CATTGCAGTGCCACCGAATAACGTATCATGATGATTTGTTGTCTCTGGAAATACC
GCTTTAGAAATAGTGGTTTTTGATACGCGCTTTCGCTGCGCAATAATATCTTCTCT
GCTAAGAGTTGCGGATGGCATACATAAACTCGCTTGATTAAGATTAATAATAAAT
AGTTAACAGTATATTGAACTGAGGGTCTGAAGAACTCTAATACCTCTGAAGAACT
TTGAGGCCGCTAGAGAGAAAAGACCAGTGATAATATTTCATCTTGCCATGAGAGC
TTATCATGAAAGCCTGTGCTTAAAATCAATCATTATATTTATTCATCTTTAATTGA
AATAATACCAATATATTTCATATATAATTTCACACTACCCTTATCTCACTAGACTT
CCCGCGCATAGGCGCAAACAATCAACGCAAGTTCACAATAAAGCGGTTCGCTGC
AACACATGCCCTAGCGTCTAAAGTAGCACGCACAACACTGGCCAGTCGTACTAGC
CCCTTTGCGATTCGTGCAGACGAGCAACAAGCGCTATTAAACTTACCTAAATTTC
TAACCACCACCATTGGTTCTTTTCCACAAACTCAAAAAACTCGTCAAATCCGCTTG
CAATTTAAACGCGATGACATAGATCTAATCGATTATCAAACCCGCATTCAAGCGC
TCATTAAAAACGCACCACTGGCAAGAAGTTCTACCTGCACTGACCAATATGCAAG
CGGCGGCGGAAGAGCTGCCTTTGATCGATCAAGAAGAAGGGAGCAGCAAAGAGG
AAAACAATCAAAAAGAGGAGAGCAATCAAATAAAAACGAGTTATTGAGGATTTT
AATTTTAAAACAGGTATATTAATACCCTCTCTCGTAGTAAACAATGACTGTATTTA
CACAAAAATAAATAGAGGTATACCATGTCAAACATCTGGTTTGAAGTACCAAAG
ATTGAAGTATTAAACCGTCAAATGGAAAATACTGCCTGCAGCAACTTAGGCATTC
AAATTACAGAAATTGGCGATGATTATATCACTGGCACAATGCCAGCAGATGCACG
TACCTTCCAGCCAATGGGACTGATTCATGGCGGCTCAAATGTATTGCTGGCAGAA
ACACTGGGCAGCATGGCAGCTAACTGCTGTATTAATTTGTCTCAAGAATATTGTG

TTGGCCAAGAAATTAACGCCAACCACATACGCGGTGTTCGTTCCGGCATAGTGAC
TGGCACAGCAACGCTAGTACACAAAGGAAGAACCTCCCAGATTTGGGAAATTCG
CATCGTTAAC*GATCCAAAGAATTCAAAAAGCTTCTCGAGAGTACTTCTAGAGCGGCCG*
CGGGCCCATCGATTTTCCACCCGGGTGGGGTACCAGGTAAGTGTACCCAATTCGCCCT
ATAGTGAGTCGTATTACAATTCACTGGCCGTCGTTTTAC

Figure 9:

Amino acid sequence of the stabilized single ring mutant Glu461Ala/Ser463Ala/Val464Ala of Cpn60:

SEQ ID No 14: Cpn10 (nucleotides 458-751of Figure 10):

MKIRPLHDRIVVRRKEEETATAGGIILPGAAAEKPNQGVVISVGTGRILDNGSVQALA
VNEGDVVVFGKYSGQNTIDIDGEELLILNESDIYGVLEA

SEQ ID No 15: Cpn60 (nucleotides 458-751 of Figure 10):

MAAKDVLFGDSARAKMLVGVNILADAVRVTLGPKGRNVVIEKSFGAPIITKDGVSV
AREIELKDKFENMGAQMVKEVASQANDQAGDGTTTATVLAQAIISEGLKSVAAGMN
PMDLKRGIDKATAAVVAAIKEQAQPCLDTKAIAQVGTISANADETVGRLIAEAMEKV
GKEGVITVEEGKGLEDELDVVEGMQFDRGYLSPYFINNQEKMTVEMENPLILLVDKK
IDNLQELLPILENVAKSGRPLLIVAEDVEGQALATLVVNNLRGTFKVAAVKAPGFGD
RRKAMLQDLAILTGGQVISEELGMSLETADPSSLGTASKVVIDKENTVIVDGAGTEAS
VNTRVDQIRAEIESSTSDYDIEKLQERVAKLAGGVAVIKVGAGSEMEMKEKKDRVD
DALHATRAAVEEGVVAGGGVALIRALSSVTVVGDNEDQNVGIALALRAMEAPIRQI
AGNAGAAGAAVVDKVKSGTGSFGFNASTGEYGDMIAMGILDPAKVTRSSLQAAASI
AGLMITTEAMVADAPVEEGAGGMPDMGGMGGMGGMPGMM

Figure 10:

SEQ ID No 16: DNA sequence of the stabilized single ring mutant Glu461Ala/Ser463Ala/Val464Ala:

In the DNA sequence:
Small letters – the Cpn10-Cpn60 coding fragment,
Big bold letters = introduced mutations

atcaaaaaatgcagcaaggacagattcctgcccaagaattagcagaaggtttcttgttagcactggccggcgctttattattaacgccgg
gttttgtcactgatgcgctgggttttacattactcgtccccgcgacgcgtaaagcgttggtccataaggtgattgcatttattaccccctc
gcatgatgactgcaagcagctttcaagcgacgggtagttttcaggaaggctcgtttaaagatgtacattcgcacactgactcgcaaagca
gtcatgaaaaaatcacaattgaaggcgaatataccaaagacgataagtaggtatttttttcggctagccgttgaaatcctagtaaaagccc
cgataaattaaccatctatttttcacagaggcaatttagcctttgtttaccttattgatcctaatacttgggatccaacagttggagagtctagc
aaatgaaaatccgtccattacatgatcgtattgttgttcgccgtaaagaagaagagaccgcaactgcgggtggtattattttacc
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aattcgaaaacatgggcgcacagatggttaaggaagttgcttctcaagccaacgaccaagccggtgacggcacaacgacagcgact
gtactagcacaggcgattatcagcgaaggcttgaaatctgttgcggctggcatgaatccaatggatcttaaacgtggtattgataaagcta
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attttatgtaactagctggcctataatgttgagttcctctgggtggcatgatctcatggtacttcacttaagcctgattcactgcg
gctttaacagtaaaataataacgcaacgtagaaacataataagcgtatggcattaatgaagacggctgcatttaattcagatc